C-ID Descriptor
Organic Chemistry for Science Majors Sequence A, with Lab

Descriptor Details

- **Descriptor Title**: Organic Chemistry for Science Majors Sequence A, with Lab
- **C-ID Number**: 160
- **Suffix**:
  - Sequence (S)
- **Units**: 10
- **Date of Last Revision**: 10/30/2024 05:56:04 PM GMT+0000

General Description

This is a one-year course in organic chemistry intended for majors in the natural sciences (chemistry, biochemistry, biology, physics, and pre-medicine).

Prerequisites

CHEM 120S; CHEM 150 is a prerequisite for the second semester course.

Corequisites

None

Advisories

It is strongly recommended that the entire Organic Chemistry sequence be completed at a single institution before transfer.

Content

The complete one-year course must include the following topics; it is understood that one or two first semester topics may be interchanged with second semester topics as needed in order to best fit program requirements.

First semester:

- Nomenclature and Functional Groups, including alkanes, alkenes, alkynes, alkyl halides
- Structure, Hybridization, Bonding, Resonance
- Acids and Bases
- Stereoisomerism and Conformational Analysis
- Addition, Elimination, Substitution and Rearrangement Mechanisms and reactive intermediates including Organometallics
- Regio- and Stereo-selectivity
- Oxidations and Reductions
- Free Radical Substitutions and Additions
- Alcohols, Phenols, and Ethers
- Infrared spectroscopy
- Organic Synthesis, including Retrosynthetic Analysis of Target Molecules

Second semester:

- Nomenclature and Functional Groups, including aromatic compounds, aldehydes and ketones, carboxylic acids and derivatives, and amines.
- Nuclear Magnetic Resonance and Mass Spectroscopy
- Aromaticity
- Electrophilic and Nucleophilic Aromatic Substitution
- Nucleophilic Additions at Carbonyls
- Reduction and Nucleophilic Substitution of Carboxylic Acid Derivatives
- Enols and Enolate Ion Reactions
- Biomolecules, such as proteins, carbohydrates, lipids and synthetic polymers
- Multi-step Synthesis of Target Organic Molecules, including Retrosynthetic Analysis

Lab Activities

The laboratory sequence will support the above topics including primarily hands-on (? 80%) qualitative and quantitative experiments that incorporate data analysis. Laboratory activities should include Chemical Safety along with the preparation, isolation, purification and characterization of Organic compounds. Techniques employed for this purpose include reflux, extraction, distillation, recrystallization, chromatography (TLC, Column, GC), melting point, Spectroscopy (IR, NMR) and Mass Spectrometry (MS).

Objectives

At the conclusion of this course, the student should be able to:

Course Objectives may be reported in a wide variety of valid ways. Learning Outcomes should be aimed at preparation for higher-level course work and will include statements related to the following

(Note these are illustrative outcomes adapted from ACS and are not intended to be prescriptive nor are they necessarily comprehensive)

Students will:

- Demonstrate an understanding of functional group transformations including redox transformations
- Assess electronic, steric, and orbital interactions & apply them to predict the behavior and properties of molecules.
- Correlate structure with reactivity and function through wet chemical methods and spectroscopy, (notably nuclear magnetic resonance and infrared spectroscopy)
- Draw reaction mechanisms using curved-arrow formalism.
- Understand solvent effects on reactivity.
- Apply thermodynamic and kinetic principles to characterize organic chemical reactions and mechanisms
- Devise multi-step syntheses of small organic molecules, including retrosynthetic analysis of target molecules
- Connect organic chemistry to biological systems
- Analyze spectroscopic data to deduce the structure of starting materials and products
- Apply chemical techniques to prepare, isolate and purify organic products
- Anticipate, recognize, and respond properly to hazards in laboratory procedures and manage chemical waste

- Recognize and evaluate elements of experimental design
- Report accurate and complete experimental records
- Interpret experimental results and draw reasonable conclusions
- Analyze data statistically to assess the reliability of experimental results
- Communicate experimental results in written form

(These are adapted from the ACS Curriculum Organic Chemistry Supplement: link to acs resource)

Evaluation Methods

A variety of assessment techniques that include examinations and written responses to lab activities and may also include active learning activities, projects, portfolios, homework problems, and laboratory practicals.

Textbooks

Organic Chemistry, Klein, Wiley

Organic Chemistry, Bruice, Pearson

Organic Chemistry, Smith, McGraw-Hill

Organic Chemistry, McMurry, Cengage

Organic Chemistry, Solomons, Wiley

Organic Chemistry, Wade, Pearsons

Introduction to Organic Laboratory Techniques: A Microscale Approach, Pavia, Cengage.

Microscale Organic Laboratory: with Multistep and Multiscale Syntheses, Mayo, Wiley

Laboratory Techniques in Organic Chemistry, Mohrig, MacMillan Learning